November 1950

METAL TREATING

MTI
MASTER CRAFTSMEN
METAL TREATING INSTITUTE

JOURNAL OF THE METAL TREATING INSTITUTE

National Trade Association of

COMMERCIAL HEAT TREATERS

The Porter Forge & Furnace, Inc., Somerville, Massachusetts—modern inside and out—another combination of the technical skill and productive equipment offered industry by the commercial heat treater. Making organizations such as this a part of industrial manufacturing facilities is sound, efficient business policy and has been the effective means of solving costly and troublesome production problems.

A FEW WELL KNOWN AJAX USERS

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Brown & Sharpe Mfg. Company
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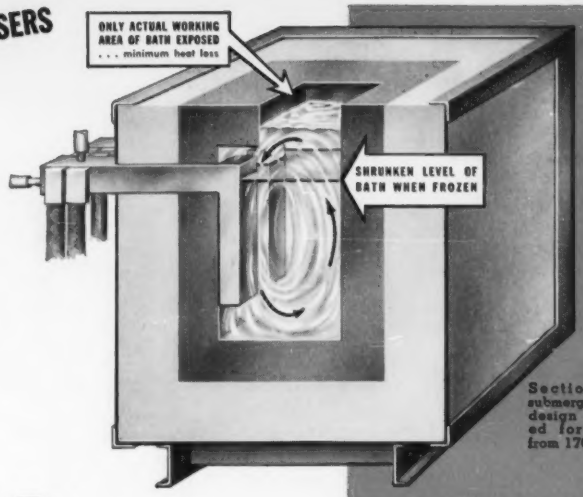
Thompson Products Company
Threadwell Tap & Die Company
Union Twist Drill Company
Wesley Steel Treating Company
Westinghouse Electric Company
. . . and dozens of others



Sectional view of submerged electrode design recommended for operations from 1700°to 2400°F.

THE Preferred Practice FOR HARDENING TOOLS AND DIES

(High Speed, High Carbon-High Chromium, Stainless and Carbon Steels)

When such an imposing array of the world's leading makers of high speed tools and dies adopt the same heat treating method and equipment, you can count on it that there's a reason—several reasons in fact.

Productive capacity is two or three times that of other heat treating methods because of faster heating.

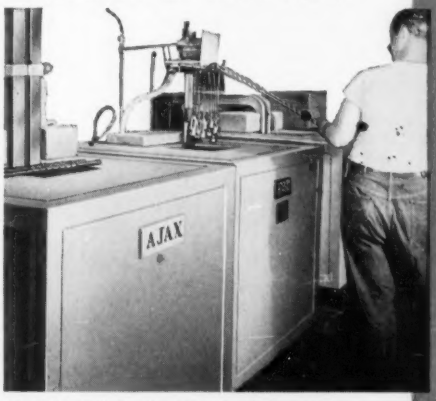
Distortion is negligible.

Surface protection is unsurpassed—because the salt bath seals the work *automatically* from all atmosphere. Scaling, decarb and pitting are avoided.

Temperature control is closer, more accurate. The temperature will not vary more than 5°F.*in any part of the bath.*

The life of tools is increased from 25% to 300% over those heated by ordinary methods.

Adaptability—The Ajax Salt Bath handles any type of high speed, carbon or alloy tool and die steel. Moreover, it occupies less floor space, does not require a skilled operator and provides maximum protection and long life for pots.



Typical installation for hardening high speed tools. Preheat, high heat and quench furnaces. The center unit operating at 2350°F. is equipped with submerged electrodes (see illustration at upper right). Preheat and quench units have suspended electrodes.

Through this unique and patented Ajax submerged electrode design, the efficiency of salt bath hardening is increased in the following ways:

Power Consumption Decreased as Much as 30%—Only the *actual working area* of bath exposed.

Electrode Life Greatly Extended—Electrodes not exposed to severe oxidizing action at surface of bath.

Bath Rectification Simplified—Oxides and dross materially reduced due to restricted bath surface.

Restarting is Easy—Closely-spaced electrodes melt salt from top downward. No danger of sealed-in pressure. No damage to pot or electrodes.

Accurate Temperature Control—Electrodynamic circulation assures temperature uniformity within 5°F. throughout bath.

Overheating of Work Eliminated—Electrodes closely-spaced, set against back wall of furnace, prevent heating current from entering work. Entire bath depth available for work.

Salt Leaks Prevented—Complete outer steel casing.

Easier Charging and Discharging—Furnace top is unobstructed.

Write for Ajax Bulletin 123

AJAX ELECTRIC COMPANY, INC.

940 Frankford Avenue, Philadelphia 23, Pa.

THE WORLD'S LARGEST MANUFACTURER OF ELECTRIC HEAT TREATING FURNACES EXCLUSIVELY

In Canada: Canadian General Electric Co., Ltd., Toronto, Ont.

Associate Companies: Ajax Electro Metallurgical Corp. • Ajax Electric Furnace Corp. Ajax Electrothermic Corp. • Ajax Engineering Corp.

AJAX HULTGREN **ELECTRIC SALT BATH FURNACES**

METAL TREATING

Official Journal of the Metal Treating Institute

Editorial...

NO IMMEDIATE CAUSE FOR ALARM

There has been some concern in the minds of many members of the Metal Treating Institute with regards to the possibility of serious loss of skilled personnel through the operation of the draft law. This was further stimulated through the release by the Defense Department of a very compact list of "critical occupations" and "essential activities." In these listings neither "heat treater" as an occupation nor "heat treating" as an activity is included. This, however, is no cause for immediate alarm, although the Institute is now preparing to take further steps to bring proper recognition by the Defense Department of the facts about the industry's essentiality.

Currently local draft boards have almost the entire say as to who or what is essential. Local selective service boards have not been issued any strict directives for their guidance. Therefore should the problem of securing deferment arise it is up to the individual employer to take his case to the board. The request must be filed within ten days of classification into I-A. With almost every member plant doing a certain amount of critical defense work and with a clear presentation of the skills required and the time necessary to acquire them, members should have little or no difficulty in assisting their employees in securing deferment.

This is not unpatriotic, rather to the contrary, because should the commercial heat treating plants of the country be crippled and their production capacities reduced, there would be practically no government or defense order which would not be substantially affected.

This, however, is no suggestion of inaction nor indifference. Collectively and individually we should take whatever steps would seem to be effective in establishing locally and nationally the true appreciation of the fundamental importance of "heat treating."

CONTENTS

NOVEMBER 1950

Vol. I No. 2

FEATURES

Batter Up! 3

The Skills Born of Specialization Solve Another Problem 4
By Arthur E. Fulton

Economical Methods for Production Hardening 6

The Customer is the Boss 11
By Ray Sault

Rectification of Neutral Salt Baths Operating at High Temperatures 12
By Stewart M. De Poy

New Things at the Metal Show 19

Oh! to be a Salesman 23

DEPARTMENTS

Institute News 2

Thermo-Couplettes 10

Manufacturers' Literature 17

Hot Tips for Salesmen 18

Personals 21

The M.T.I. Membership 24

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Institute News...

Forms New Company

Howard N. Bosworth, President, announces the formation of the Bosworth Steel Treating Company, with plant facilities at West Chicago Blvd., and Southfield Rd., Detroit.

Formerly vice-president and general manager of the Vincent Steel Process Co., Detroit, with which firm he has been associated since 1938, Mr. Bosworth has been active in the heat treating and metallurgical fields for the past 26 years. He is a member of the executive committee of the Detroit chapter of the American Society for Metals and the Metal Treating Institute and is president of the Detroit Metal Treaters Association.

James D. Thompson, formerly secretary and general manager of the Standard Steel Treating Co., is vice-president and treasurer of Bosworth Steel. Mr. Thompson also serves as vice-president of the Detroit Metal Treaters Association.

The new company will offer complete heat treating services and will specialize in gas cyaniding, gas carburizing, carbon restoration and clean hardening, with a plant capacity of 76,800 pounds of steel per day.

Fall M.T.I. Meeting Big Success

The annual Fall meeting of the Metal Treating Institute was held at the Hotel Webster in Chicago, Illinois, on October 19-22. As a matter of record for the members, a condensed program is printed below:

PROGRAM
METAL TREATING INSTITUTE
FALL MEETING — 1950

Thursday Evening, October 19
"Get Acquainted Cocktail Party"
Place: Rose Room, Webster Hotel
Time: 7:00 P.M.
Dinner: 8:30 P.M.

Friday, October 20 — 9:00 A.M. - 4:00 P.M.
MORNING
Nominating Committee Meeting
Registration
Welcome by President
Roll Call
Minutes of Previous Meeting
Report of Secretary
Report of Treasurer
Report of Publications Committee — Horace C. Knerr
C. E. Herington, Editor METAL TREATING
Report of Constitution and By-Laws Revision Committee — Purdy Benedict
AFTERNOON
NOTE: This session will be for the meetings of the duction costs."
PANEL: Howard Bosworth, Chairman
Executive Committee, Board of Directors and Nominating Committee only.
Plant Visitations: All Chicago Member Plants will be open for visit. See Bob Davis or Bob Segar for transportation.

Saturday, October 21 — 10:00 A.M. - 4:00 P.M.
Panel Discussion on "What can the commercial metal treating industry do to offset rising pro-
L. P. Josephs, L. Miel, H. Knerr, C. Hewitt
Panel Discussion on "General Policies as to settlement of claims."
PANEL: C. Graham, Chairman
A. D. Bach, E. P. Stenger, A. Eklund, A. M. Cox.
Report will be made by Nominating Committee. Election of officers.

Saturday Night
Cocktail Party in Rose Room at 6:00 P.M.
Banquet in Rose Room at 7:30 P.M.

Sunday, October 22 — 10:00 A.M. - 1.00 P.M.
Report and Recommendations of Board of Directors
Discussion and Vote on Constitutional Revision
Unfinished Business
New Business
Installation of New Officers

The meetings were attended by between 50 and 60 representatives and a number of guests and prospective members were present.

The following officers, directors and trustees were elected for the period beginning November, 1950 to November, 1951:

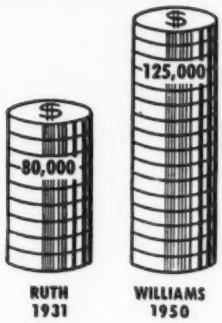
President—Mr. J. Walter Rex, J. W. Rex Co., Lansdale, Pa.

Vice-President—Mr. George Harris, Harris Metals Treating Co., Racine, Wisconsin

(Please turn to page 21)

BATTER UP!

Ted Williams, the Boston Red Sox slugger, has just signed up for a salary of $125,000. In 1931 Babe Ruth headed the list with his $80,000 salary.



But after the income tax reaper came along in 1931, and the reaper of 1950 happens by, it is found that Ruth got more *take-home* pay out of his $80,000 than Williams will get out of his $125,000.

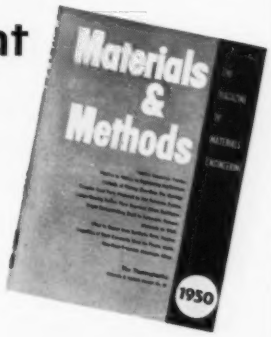
But considering what inflation has done to the buying power of the dollar since 1931, Williams' take-home pay will buy in 1950 only a little more than half of what Ruth could buy in 1931. If Williams' 1950 dollar had as much buying power as Ruth's dollar had in 1931, then Williams' salary would have to be around $330,000.

Rather interesting!

—Gridley Adams
in *Printers' Ink*

FACT-BOOK

on the properties and heat treatment of materials . . .



Materials & Methods

For authoritative information on methods for changing or improving the properties of materials, men in the product manufacturing industries turn to the pages of MATERIALS & METHODS. This is the magazine which brings these men useful, factual data in feature editorial articles like these — published in the last few months:

"Finishes Baked On Nonferrous Products by Induction Heating"
"Flame Hardening for Surface Hardening Steels and Irons"
"Salt Baths Perform Variety of Metal Cleaning Jobs"
"Selecting Steels and Heat Treatments for Automotive Gears"
"Carburizing Pastes Permit Low-Cost Selective Hardening"
"Bright Carbonitriding Steel in Automatic Furnaces"
"Heat Treating Stainless Steels" (M&M Manual 59)

Proof of M&M's ever increasing value to materials engineering men lies in the fact that M&M is the only magazine serving the product manufacturing industries to register substantial gains in paid circulation in the past year.

Today, more than 18,000* technical and management men responsible for materials-selection and materials-processing pay to read MATERIALS & METHODS.

* From June, 1950 ABC Publisher's Statement

Materials & Methods
The Magazine of Materials Engineering
A REINHOLD PUBLICATION
330 West 42nd Street, New York 18, N. Y.

The Skills Born of Specialization Solve Another Problem

By
ARTHUR E. FULTON, Plant. Supt.
J. W. Rex Company
Lansdale, Pa.

Upon conversion to peacetime production after World War II a large manufacturer of household refrigerators set up a production line including a specialized heat treating section for the case hardening of crankshafts for compressor units.

This shaft (Fig. 1) was forged from C1118 steel, machined and then ready for heat treating. Requirements were a case depth of .025" minimum to .035" maximum. Rockwell hardness of 66.5 to 72 on "45" N scale and total eccentricity to be .005" for overall length, total indicator reading. The shaft was 6⅞" long and ¾" O.D. with a single throw of 1¼" from one end with two longitudinal lubricating holes ⅛" in diameter—one 1¾" deep and one 2 3/16" deep on this end. These two lubricating holes must be kept free of all dirt and obstructions and the shaft MUST be kept free of any scale and coating that would be objectionable to subsequent finish grind operations.

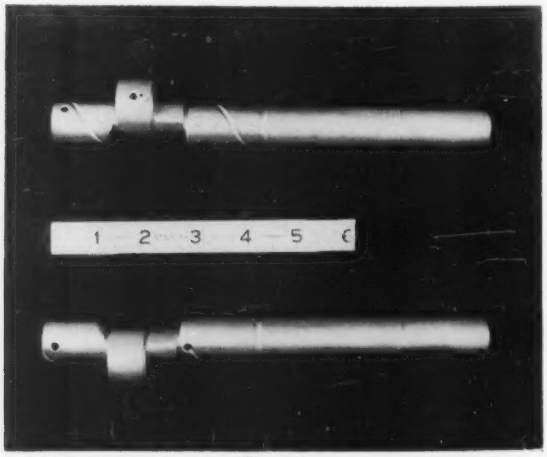


Figure 1
Specifications for this forged steel crankshaft created some difficult heat treating problems.

The manufacturer's set up was put into operation and during several months of operation all types of headaches presented themselves. Warpage, straightening to tolerances, plus rejections for spotty hardness lost almost fifty per cent of the production of these shafts. Something had to be done!

We, as a commercial heat treater, were then called into conference and given sample shafts and the specifications required and told to produce the perfect shaft and produce it fast.

Basic procedures were used at first to determine hardness and warpage characteristics. Samples were pack carburized and brine quenched on reheat from cyanide pots, tempered and checked. Hardness was found to be satisfactory but warpage was another problem. About seventy-five per cent had warped beyond tolerance and upon straightening seventy per cent were broken because of no ductility in the core. The same procedure was then used and instead of using brine as a quenching medium, a light oil at about 120°F was substituted. This reduced distortion but hardness of case was borderline.

After one week of experimentation, one procedure proved itself to be as nearly perfect as is possible. The shafts were carefully packed in dry carburizing compound and carburized for four hours at 1700°F and cooled in the carburizing containers. It was especially essential that the shafts be packed with the two longitudinal holes down to prevent the compound from clogging up these two lubricating holes. Parts were then unpacked carefully from the containers and sent to the cyanide department where they were then suspended on stainless wire loops in an extremely weak sodium cyanide bath. This bath was of about 2 to 5% cyanide content and was constantly checked to keep the cyanide close to 5%. The shafts were immersed in this bath at 1500° until soaked through and then quenched in a nitrate salt bath at 425°-450°F maximum for four to five minutes and air cooled to room temperature. CONSTANT CHECK OF THIS BATH WAS ALSO MADE TO PREVENT ANY HAZARD OF EXPLOSION. Removal of salt coating was then accomplished by suspending in a bath of boiling hot water for ten minutes. All salt was then dissolved from all surfaces including the lubricating holes. Tempering of the shafts at 400° was accomplished in a recirculating gas fired furnace for one hour.

The parts were next moved to inspection where they were Rockwell checked for hardness and also air checked to be sure the lubricating holes were clean. Straightness check was then taken with less than five per cent requiring straightening, and those out of tolerance were easily straightened because of a very ductile core. Straightening was accomplished by striking with a hammer at the high spot on two small Vee Blocks. The shafts were then dipped in an anti-rust oil and shipped.

With the above procedure we were able to reduce the cost for the manufacturer by almost fifty per cent in comparison with their own inefficient set-up.

Our rejections were less than one-half per cent and this rejection occurred entirely in the straightening and grinding operation. In the straightening operation, less than five per cent of the total treated shafts required straightening to within tolerance. Average run out as hardened and tempered was approximately .003".

Another problem solved—solved, not by elaborate equipment and engineers, but by sound theory—a *specialized* knowledge of practical heat treatment and persistence in "licking a stubborn job." ALL heat treat jobs can be as successfully and economically run in the commercial heat treating plant if the problem is thoroughly studied and the answer carefully worked out.

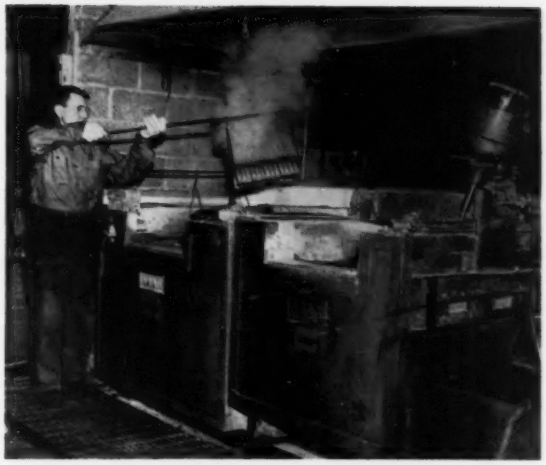


Figure 3
Ajax electrically heated salt bath furnaces.

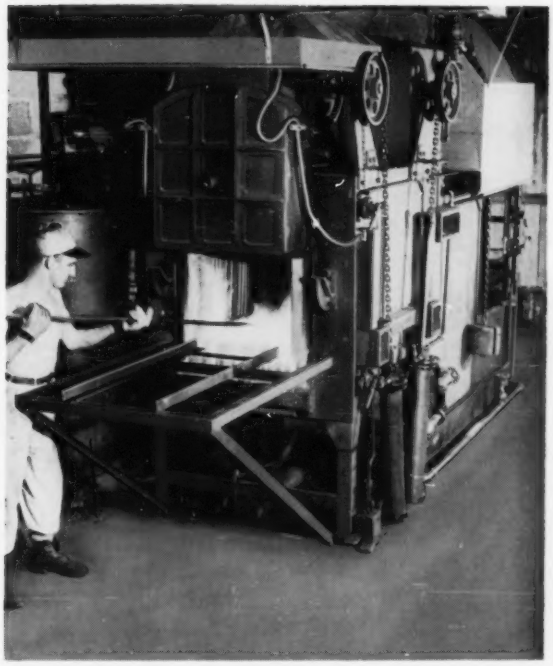


Figure 2
Lindberg Hydrizing Furnace with mechanical type pusher and elevator-type quenching mechanism.

Figure 4
Battery of Super Cyclone Furnaces—Temperatures up to 1750° F.

The specialized skills and equipment of the J. W. Rex Co., Lansdale, Pa. solved them all.

Commercial Heat Treaters *Buy*

A recent study reveals that the members of Metal Treating Institute spend as a group $200,000 each month for supplies, fuel and equipment. You can reach those who make the *Buying* decisions about your products in "Metal Treating", the only official Journal of the M. T. I.

Economical Methods for Production Hardening

A condensation of a recorded panel discussion held during a joint meeting of Metal Treating Institute members and the American Society for Metals. Presented through courtesy of E. Thum, Editor – "Metal Progress".

Several panel-type discussions were held at the 1949 annual convention of the American Society for Metals. One of the most vigorous considered the problem of getting hard, wear resistant surfaces on important steel parts, made in large numbers. Five commercial methods were upheld by as many different metallurgists—namely, carburizing, induction hardening, flame hardening, controlled atmosphere heating and salt baths. Many sound opinions were expressed, some apparently conflicting in detail, but all conforming to the basic principle offered by the Moderator of this discussion, Horace C. Knerr, President of Metallurgical Laboratories, Inc. (Metlab Co.) Philadelphia, Pa., that every heat treating job is an engineering problem involving mechanics, materials and methods, all aspects of which must be weighed and coordinated if true economy in production is to be achieved.

The panel members were:

Ralph L. Wilson, director of metallurgy at Timkin Roller Bearing Co., Canton, Ohio

Glen C. Riegel, chief metallurgist of the Caterpillar Tractor Co. of Peoria, Ill.

Robert H. Lundquist, supervisor of metallurgical department, Minneapolis-Moline Co., Minneapolis, Minn.

C. H. Leland, assistant furnace engineer of Buick Motor Co., Flint, Mich.

W. E. Bancroft, chief metallurgist, Pratt & Whitney Division of Niles, Bement, Pond Co., West Hartford, Conn.

Chairman Knerr – As the newspapers say of their columnists, the opinions expressed by the gentlemen on the panel will be strictly their own. You in the audience are permitted to differ from them, or they from each other, without limitation. They have been given the euphoneous title of experts but probably there are more experts on the other side of the footlights than there are on this side. Your chairman is merely in the position of interlocutor and he is not supposed to have any opinions.

We have been asked to slant our comments toward "Economy in Production." Maybe it will do some good if the chairman attempts to define this scope—that is, to define "economy." Briefly, economy is making the dollar go as far as you can. You have only to state it that way to realize that there are various aspects of the proposition. The first, of course, is to produce a unit at the lowest cost but still have it good enough for the purpose intended. Even that covers a great deal of ground. If you are, for instance, making parts for a roadster you wouldn't make them strong enough for a ten ton truck. Another aspect of economy relates to productive space in the plant. If you can produce twice as much in half the space, you have economized in overhead and capital investment. Another aspect is the simplification of movement of materials; if by some device or operation you can avoid a long trek through the plant, or prevent shutdowns through machine failures you may achieve economy in production even though the extra operations and the extra maintenance cost some money. Another very important feature is better quality control for uniform production, less rejections, and (most particularly) gains through good will on the part of the customer and user of a satisfactory product. We are satisfied with our telephone because it is practically never out of commission.

Mr. Wilson, will you now bring these generalities down to earth with some specific information gained in your life-time of work with mechanical bearings?

Wilson—Everyone in this room probably knows that roller bearing races are made of carburized rings; ball bearings are of high-carbon alloy steel through hardened; roller bearings are usually carburized. Why this difference? In general (and this applies to a wide variety of machine parts, not just mechanical bearings) carburizing or surface hardening is a means of supplying articles with a hard surface for wear; deep hardening or through hardening is usually for strength. However, there are other considerations: First of all, the carburizing steels are low-cost materials, series for series; that is, S.A.E. 3115 for carburizing costs less, piece for piece than 3145 in the finished form ready for use. The low-carbon, carburizing steels also respond to very simple treatments which will put them in condition for machining, and the machining rates are good. Whenever welding operations are involved, low carbon content is an advantage. If the piece is to be upset or cold formed, the easy formability of the low-carbon materials is a distinct asset.

What this amounts to is that the balance of economy in all operations up to the point of hardening is on the side of low-carbon steels. Admittedly, carburizing, quenching and drawing is more expensive than heating, quenching and drawing, but in many instances the prior savings counterbalance this. In others, the subsequent operations are more economical; frequently the piece has superior durability. If the heat treatment has been proper there is a valuable compression in the outermost layer of the case, which proves to be very advantageous in many applications where working stresses are of torsional nature, or where surface fatigue due to rolling action must be avoided. Certain case hardened parts can be fixture quenched to control the distortion—to keep it to a minimum—and thereby reduce the amount of grind-

ing stock necessary, and the danger of grinding damage to the hardened surface.

Lundquist—Ralph, do I gather that you would go as far as you could in substituting carburized steel, for through hardening steels? Is there a saving in almost any part?

Wilson—No. You must be sure that you are balancing all the factors that enter into such a problem. I can take the example, very familiar to me, of antifriction bearings. The standard ball bearing steel is a high-carbon material that must be spheroidize-annealed for machining. It is then hardened simply by oil quenching. The competing antifriction bearings, the roller bearings, are made of carburizing and hardening steels. They can be machined very much easier; the cost of carburizing is about the same as for the spheroidizing treatment, and the hardened parts are much easier to grind—that is, there is less grinding stock and also less possibility of grinding injury. Now some other combination of operations on a different part might well indicate that the through hardening steels should be used. You must analyze each job on its own merits.

Audience Questioner—Would Mr. Wilson agree with the statement that carburized steels are less liable to cracking during hardening—especially in complicated shapes with unbalanced sections?

Wilson—Generally, I think that is so. If distortion were a particular problem, you would pick a low-alloy steel that would give the smallest movement by means of oil quenching. If high surface hardness is required, the part could be carburized, either on the whole surface or differentially where needed. Even without carburizing, several modern alloy steels have considerable hardenability in large section that would take care of many hard jobs that come to mind. For example, the steels high in nickel seem to have the ability to deform plastically and distribute loads so that, in a great many applications, we can sustain greater loads or give greater capacity ratings to these same articles than if they were made of the through hardening steel giving the same hardness.

Knerr—May I summarize your thoughts in saying that preparatory costs such as raw material, machining and forming are lower for carburizing grades, and that proper distribution of internal stress for dimensional stability, good wear resistance and endurance are also on the side of carburized parts? On the other hand, highly stressed parts will usually require through hardening steels.

Wilson—A pretty fair summary. I might add that the old, old arguments concerning carburized versus deep hardened gears bring in the same considerations—do you want, primarily, a wear resistant gear or a strong gear? Carburizing, you know, is not confined to small parts—some very husky pieces are case hardened, as I can show.

Knerr—First, let us ask Glen Riegel about the conditions at Caterpillar that have warranted such extensive use of surface hardening by induction heat. In this scheme, only the surface layers of the part which need to be hardened, are heated and quenched.

Riegel—One of the first things that we ask ourselves when we undertake a new process is, "What do we expect to obtain from this process?" Either there must be a benefit in making a more satisfactory part from a consumer's standpoint, or there must be some economy in the materials that are used in its production, or there must be some man-hours saved in processing the part through heat treatment, or there must be some floor and space saving, or else there must be convenience in the shop layout that avoids expensive handling operations. Usually more than one of those factors have induced our firm to install a number of induction hardening operations.

One of our earliest successes has been well publicized.* It concerns the "bull gear," so-called, the large final drive gear on the Caterpillar D-8 tractor, a 171/2-ton machine. The gear was previously made of 3½% nickel steel, 0.45% carbon, through hardened and tempered to C-40 at the surface. Cleaning up distortion in a Fellows Shaper left the gear softer than it should have been for good service and consequently after 100 hours of full load the gear teeth would be badly pitted.

In the early 1940's we decided that by selective heating, lower cost materials could be made harder and more accurate. This turned out to be true, because this gear, which is about 26 in. outside diameter and a 5-in. face, has since been made out of 1045 steel, saving something like 12¼ lb. of nickel for each gear blank — a great economy during wartime. Furthermore, the final hardness and accuracy of the part was vastly improved. As shown in the hardness survey (Fig. 1), the bearing areas (after induction hardening

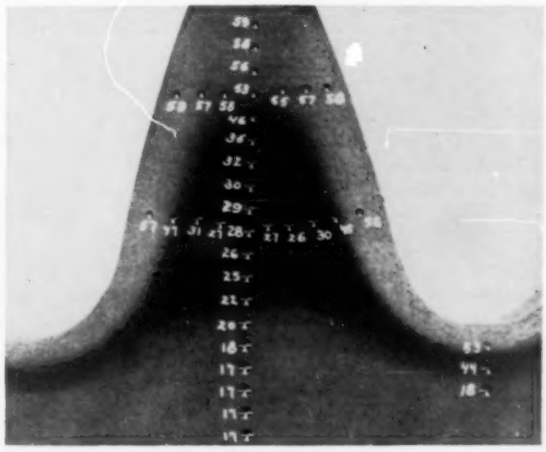


Figure 1
Hardened Survey (Rockwell C Scale) of hardened Tooth, Sectioned on Center. Magnified 2¾ diameters.

* Editor's Note—See, for example, *Metal Progress* for July 1943, p. 78-83.

and tempering) approached C-60 in hardness. Finish machining now involves only crown shaving. Previously, shaper tools would finish only four gears; now, the crown shaving tools are good for hundreds, literally.

Wilson—I suppose, Glen, you have studied the possibility of carburizing that gear followed by a selective hardening—localized heating to produce hard wear on the surface.

Riegel—Yes, that has been done experimentally, but usually the distortion during the carburizing heat is greater than that which occurs in induction hardening.

Wilson—Then you would say that with 1045 steel, which is relatively cheap, the over-all cost is less with induction hardening.

Riegel—I feel quite sure that is true, because of the relatively high cost of carburizing as compared with induction heat treatment.

Wilson—I wasn't aware that carburizing is a very expensive operation, if it can be done in any quantity.

Riegel—I would not want to guess what your costs of the carburizing operation are at Timken, but I am sure that when we purchase carburizing from commercial heat treaters, it runs into money.

Chairman Knerr—Mr. Riegel, you don't seem to agree with your neighbor. Mr. Wilson seemed to think that it is better to carburize than to use too hard a steel and you take the opposite view. Now can't we get together here, or else get a little further apart?

Wilson—Possibly we hand-picked our examples. I wanted to show that there are instances where the carburizing could supplant practices based on the use of through hardening steels, and I have no doubt that the men on this program who work with induction hardening and flame hardening can find some splendid examples to the contrary.

Chairman Knerr—In fact we have here Bob Lundquist who hardens bull gears, I think, much like Riegel's, only he uses a gas flame.

Lundquist—Before tellling about the details, which have been given in the October 1949 issue of Metal Progress, I would especially emphasize the angle of customer satisfaction. If you can keep a customer satisfied by turning out a high quality product—if you can improve your methods so as to give him a better product at the same cost, you are going to be in business a lot longer and you are going to do a lot more business. The result is economy. We have all been talking about making the best possible part at the lowest possible cost.

Now in emphasizing the best possible gear for heavy duty, I want to emphasize that you must have compressive stresses in the wearing surfaces. You can get that by carburizing; you can get it by induction hardening; or you can get it by flame hardening—provided only that the processes are carried on intelligently. Now, Glen Riegel's induction hardened bull gear is a good gear and performs very well. We have been able to do about the same job by flame hardening a 1038 steel gear with natural gas of about 1000 b.t.u. per cu. ft. heating value, mixed 1 to 10 with compressed air and by burning that fuel in a circular, multi-burner fixture surrounding the gear. When the teeth of the ring gear are properly heated, the center spider is inserted and the assembly so immersed in a water quench. (The entire operation, by the way, is a semi-automatic cycle.) Thus quenching and shrinking are simultaneous, and I have no doubt that the rigid, cold center or spider is a great aid in maintaining close dimensional tolerances on the teeth. As is seen by the hardness survey (Fig. 2) we get about C-50 at the root diameter and C-54 to C-55 at the pitch diameter on the wearing face. That gear performs very well.

Some of the advantages of flame hardening over furnace hardening are, of course, that you are heating only the portion of the gear that you want to harden; for that reason you save b.t.u.'s and b.t.u.'s cost money. You get less distortion, you get higher hardness. Our former practice was to through harden the gear and draw it back to about Rockwell C-40. Less floor space is required for flame hardening equipment, about one-third the floor space that would be necessary for furnaces. There is a smoother flow of work through the heat treating department and production can be paced in step with the machine shop in a much nicer way. Finally, and this is paramount, the customer gets much better service in the tractors.

Leland—Bob, you mentioned that you immersed the hot gears in water or do you mean that you simply had an unagitated quench when the gears were lowered into a tank?

Lundquist—No, we have a very good agitation in

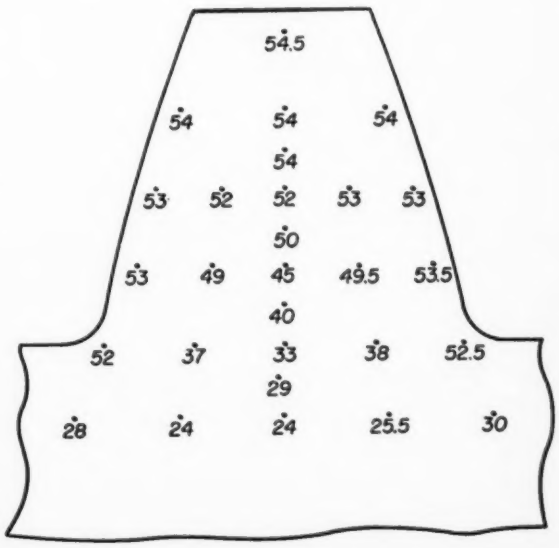


Figure 2
Typical Hardness Survey of Gear Tooth

that water quench by a submerged spray-ring which flushes water into the spaces between the teeth, in order to "wipe off" steam pockets. It is a very good quench.

Wilson—Do you make any carburized or through hardened gears?

Lundquist—Absolutely. I think flame hardening has its place, I think carburizing has its place, and induction hardening certainly does have a place. I think it is a matter for intelligent investigation and selection.

Knerr—Could you be a little more specific.

Lundquist—We have several examples where we induction harden parts it would not be practical to flame harden. For example, we have some counter shafts of irregular shape hardened only on the bearing ends. They are about 1½ in. diameter and about 1½ feet long.

Knerr—Bob, would you always flame harden when you could flame harden? Apparently Glen Riegel would always induction harden where it can be done and Ralph Wilson would always carburize. Would you correct that assumption?

Riegel—I would say, Mr. Chairman, that the bias which you acquire with certain successes may last too long. It may be that we could flame harden some things more economically than where we induction harden, but if the production is great enough and if the quantities scheduled are suffiiciently large that set-up times are minimized, then from the energy standpoint and from the labor standpoint, we find induction hardening preferrable over flame hardening. However, that does not mean that Caterpillar metallurgists exclude flame hardening from our operations. We have certain parts that are flame hardened.

Bancroft—Can anyone clear me on this? In induction hardening the heat is created inside—within the body of the metal—whereas in fiame hardening it is forced in from the outside. Do you feel that there is any real difference, any metallurgical distinction or economical preference between the two?

Riegel—Well, the higher the external thermal head, the hazard of grain growth is that much greater. In other words, if you use a flame temperature of 3600° F. it doesn't take very long to melt the steel at the surface, whereas if you can induce heat into the surface layers of the steel at a lower temperature, the likelihood is that you would be metalurgically safer. Certainly this is true on sections with irregular surfaces—protuding corners.

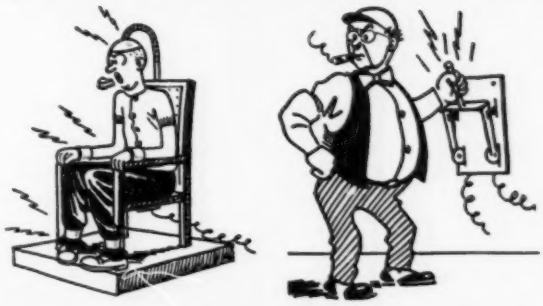
Lundquist—Let me emphasize that with the type of flame hardening we use on Minneapolis-Moline gears, temperatures are relatively low. We don't even approach the ordinary temperature of the oxy-acetylene welding flame. In practice, the gears are not grain coarsened. On the other hand I have seen induction hardened gears where the tooth tips have melted right down. Its a horse apiece as far as that is concerned. I think the whole point of this discussion is that any method has to be used intelligently.

Chairman Knerr—If you use enough energy or heat you are going to melt something, that's certain. The point is—control. Either method will produce very satisfactory results with the best of controls. Certainly, with the kind of energy that is usually poured in by electrical induction, it's just seconds away from melting. However, you didn't answer one of my questions. What are the reasons why you would choose one method in preference to the other?

Lunquist—I think that the choice would be principally dependent upon the production that is required. Our company is a relatively small producer, and for that reason flame hardening is well adapted to our production, which is rather small. We build about 100 tractors a day which means about 200 final drive bull gears a day. If it were a matter of 1000 or 2000 gears, perhaps the induction method would be more economical.

Chairman Knerr—Thank you, Mr. Lundquist. Let me ask Mr. C. H. Leland about Buick Motor's mass production methods with gas atmospheres. (*To be continued—January* METAL TREATING.)

WE WOULD LIKE TO PULL THE SWITCH ON . . .



The dim-wit who talks about capital and labor, but never had any capital, or never did much labor. (We think we have used this before, but it's always good.)

A certain Jake Green visited a Texas town several months ago. He found the only hotel filled to the roof.

Clerk: No sir, I can't give you a room. The best I can do for you is to give you half of a private dining room. There's a screen across it, and a lady is in the other half, but I reckon she won't bother you.

Jake agreed that the accommodations would do in a pinch, and retired to his apartment. A half-hour later he ran into the lobby wild-eyed and pale.

Jake: Hey, that woman is dead.

Clerk: I know it, but how did you find it out?

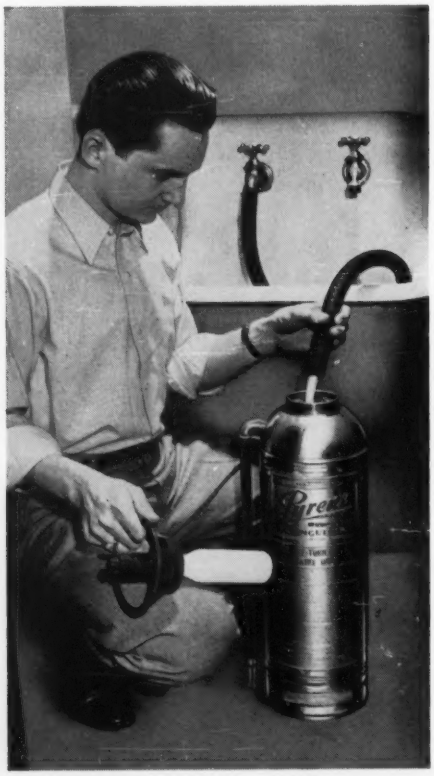
THERMO-COUPLETTES . . .

Stainless-Steel, Gas-Charged Pyrenes Will Replace Soda-Acid Extinguishers

Pyrene Manufacturing Company, Newark, New Jersey, has developed a new, cartridge-operated water type fire extinguisher with stainless steel shell which, it is claimed, has numerous advantages over the riveted-copper, soda-acid type long used in restaurants, hotels, offices, factories and institutions.

Eliminated is the annual cost and nuisance of recharging necessary with the soda-acid extinguisher. The carbon dioxide pressure cartridge need be replaced and the water replenished only if the extinguisher is discharged.

When the extinguisher is turned upside down and struck on the floor, the gas, contained in the cartridge fitted into the extinguisher cap, is released inside gradually. As a result a steady 40-foot stream is easily directed from a safe distance.



Having carbon dioxide as an expellant eliminates the job of mixing soda into the water and the hazard of handling or having acid around—a very special danger where there are pranksters, mental patients or criminals.

More modern and attractive in appearance, the satin finish of the stainless steel remains beautiful, is easily dusted.

The extinguisher is 5 pounds lighter, easier to carry and operate. Yet it is stronger and is tested to 500 pounds rather than the customary 350 pounds for riveted units—a 43% higher test.

Another feature of the new extinguisher is a plastic, transparent nozzle. It is tough; resists mistreatment which might change the shape or size of the opening of the commonly used lead nozzle. Should it be plugged deliberately, the foreign matter can be seen and removed.

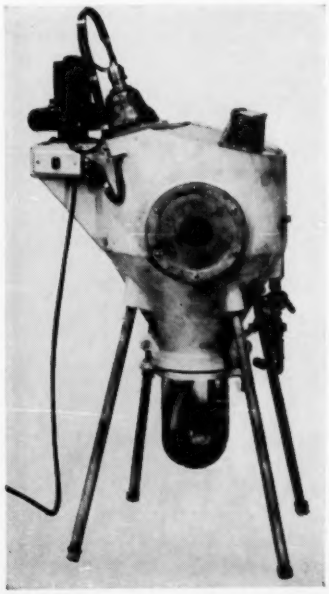
For the first time, the cost has been lowered to a point where it is only slightly more than the soda-acid which it is destined to replace. And the savings in maintenance time and materials will pay for the difference in one to two years.

Pyrene has discontinued the manufacture of riveted type copper extinguishers, is continuing to produce seamless drawn copper alloy extinguishers. Stainless steel welded extinguishers, in addition to the cartridge-operated water type described above, will also be available, in soda-acid and foam types.

New, Compact Cleaning Unit

Pangborn Hydro-Finish—a recent development in the blast cleaning field—is now available in a brand new small size cabinet designed to bring the liquid blasting process within reach of hundreds of new users requiring a small, low cost unit.

(Please turn to page 22)



The Customer Is The *Boss*

By
RAY SAULT
Porter Forge & Furnace, Inc.
Somerville, Mass.

How important is attention to customer relations in the Heat Treating business? Before you answer this stop to think a moment of the number of actual contacts you have with your customers. All of us know that with the exception of a retail store there is scarcely a business where trade actually comes to the door more often than to the heat treaters. Customers not only come to leave work but again to pick it up. A good majority are this double-call type of cilent, but, how much attention do you pay to them?

The problem should be approached from three angles; first, Shipping and Receiving; second, Office; and, third, Outside Representation.

1. *Shipping and Receiving*
   (a) This area should be ample in space to accommodate the receiving and shipping of small or medium orders.
   (b) It should be well lighted, clean, and easily accessible; above all—*CLEAN*.
   (c) Personnel should be selected for pleasing personality, be intelligent, well-paid and trained in the line well enough to talk to metal-minded men.
   (d) Parking space should be provided where possible, if not, as much curb area as can be obtained should be marked "RESERVED."
   (e) Encourage personnel to cultivate motor freight carrier employees for future needs.
   (f) Business-like systems for recording and signature forms are a must. The makeup and type are, of course, management's own ideas of those proper for efficient conduct of the business.
2. *Office*
   (a) Telephone contact requires politeness, tact and knowledge. The telephone operator or person handling calls should be able to classify calls. Telephone courtesy is a prime requisite. All personnel answering calls should never be short with the caller but give him all the time needed to get full information.
   (b) The metallurgist, production man, or clerk should, after a few calls, use the caller's first name if he identifies himself in this way. Most people warm to the intimacy of their first name thereby instilling confidence.
   (c) Attention should be paid to customer billing and shipping instructions. Practically every purchase order asks for a definite number of invoice copies for customer's convenience or gives preferred shipping means.
   (d) A good metallurgist is a prime requisite. This person (often yourself) should appreciate the customer's viewpoint and be able to help him with his problems. His theory should be backed up with good practical shop experience and some knowledge of machine shop and manufacturing procedures.
   (e) A good, readily available price list is a necessity. This list should cover charges by the pound, hour or job and be complete enough to enable anyone in the office with knowledge of customer requirements to use it for quoting. A prospect may be irked by not being able to get prices immediately.
3. *Outside Representative* (Often called a salesman, but representative is more to the point in a service organization)
   (a) Must be shop trained and mechanically inclined.
   (b) Essential that he be fully informed as to company policies, prices and office-customer dealings.
   (c) Should have good personality, appearance, and be of high calibre.
   (d) He can strengthen service by delivering small important rush jobs in extreme necessity.

It is so apparent that good customer relations are of such prime importance to the Heat Treating business that considerable thought, care, and consideration should be given the subject. A clean serviceable shipping and receiving room with pleasant, well-trained personnel is of main importance as it is here that the greater amount of customer contact is made. A good front is often responsible for success. Courteous telephone service combined with fair prices and competent metallurgical knowledge backed up by competent outside representation make a combination that solidifies client patronage.

All customer contact personnel should at all times be aware of the importance of work brought for processing, regardless of size or quantity. The smallest charged item often represents value beyond monetary consideration because of the time, effort, planning, and skill put into its making. It is important that the smallest piece of work be well done as it is often a "LEADER" for bigger, better volume production.

Say that you saw it in
"METAL TREATING"

Rectification of Neutral Salt Baths Operating at High Temperatures

By STEWART M. DE POY, *Metallurgist*
Dayton Forging & Heat Treating Co.
Dayton, Ohio

ABSTRACT.

Three test runs were made on a neutral salt operating at high temperatures to determine a process for eliminating oxides from the bath. One bath was rectified with Silica ($Si O_2$), one with a graphite rod inserted wholly below the surface of the bath, and one bath was operated without the use of a rectifier. Results proved that rectification with the graphite rod practically eliminates decarburization from the work passing through the bath. Elimination of the oxides also prolongs the electrode life of the furnace.

EQUIPMENT AND MATERIALS.

The tests were run in Ajax Internal Electrode Furnaces. The salt used was G.M. 1850-M composed of 95% Ba Cl_2 and 5% Na Cl, and furnished by the E. F. Houghton & Co. The samples were M-2 High Speed Steel. The supplier, heat number and analysis are as follows:

Supplier	*Heat No.*	*C*	*Cr*	*Mo*	*W*	*Va*
Latrobe Electric Steel Co.	22319	.84	4.12	5.08	6.47	1.81
Universal Cyclops Steel Co.	D-5087	.80	4.20	5.10	6.46	1.91
Latrobe Electric Steel Co.	22311	.86	4.15	4.97	6.56	1.82

TABLE I

Salt: E. F. Houghton & Co.'s Liquid Heat 1550—G.M. Specification #1850-M
Test Piece: G.M. M2 Steel—Latrobe Electric Steel Co.—Heat #22319
Original Carbon Content: .84%
Operating Temperature: 2225°F.
Rectifier: NONE.
Maximum Electrode Life: 2650 hours or 110 days.

Age of Bath	Soaking Time of Test Pc.	Oxide Content of Bath		Carbon Content .005" Outside Layer	Loss of Carbon	Decarburization Index
		Soluble	Insoluble			
Hours	Minutes	%	%	%		
240	5	1.60	1.96	.76	.08	9.5
240	10	1.60	1.96	.75	.09	10.7
240	15	1.60	1.96	.60	.24	28.6
264	5	2.00	3.50	.72	.12	14.3
360	5	2.12	3.10	.70	.14	16.7
398	5	2.21	2.90	.73	.11	13.1
494	5	2.18	4.00	.73	.11	13.1
542	5	2.43	2.80	.73	.11	13.1
590	5	2.56	3.10	.72	.12	14.3
662	5	2.28	2.52	.58	.26	31.0
662	10	2.28	2.52	.55	.29	34.5
662	15	2.28	2.52	.52	.32	38.1

A standard carbon train was used for carbon determinations and a Wilson Tukon Hardness tester was used to determine hardness tests.

Procedure

The samples were fabricated from various size materials into ⅜" dia. test pieces. After removal of sufficient stock to eliminate mill scale, some turnings from the original pieces were analyzed to determine the original analysis. Since carbon was the item in question, two rechecks were run to insure accuracy. These checks were uniform within .01% of carbon.

At various times during the life of the hardening bath the samples were placed in the bath for 5, 10 and 15 minute intervals. They were then allowed to cool in air. (At the outset of this work, the samples were quenched in a cyanide bearing quenching salt. This operation gave an actual increase in surface carbon.) The samples were then washed thoroughly, tempered at 1050° F in nitrate salts, super cooled to −120° F, and retempered at 1050° F. After the hardening operation, the samples were cut into two equal parts.

TABLE II

Salt: E. F. Houghton & Co.'s Liquid Heat 1550—G.M. Specification #1850-M
Test Piece: G.M.—M2 Steel—Latrobe Electric Steel Co.—Heat #22311
Original Carbon Content: .86%
Operating Temperature: 2225°F.
Rectifier: 2 oz. of SiO2 added 24 hours
Average Electrode Life: 720 Hours or 30 Days

Age of Bath	Soaking Time of Test Pc	Oxide Content of Bath		Carbon Content .005" Outside Layer	Loss of Carbon	Decarburization Index
Hours	Minutes	Soluble %	Insoluble %	%		
264	5	1.60	1.49	.82	.04	4.7
264	10	1.60	1.49	.80	.06	7.0
264	15	1.60	1.49	.74	.12	14.0
384	5	1.19	2.70	.79	.07	8.1
408	5	1.48	2.62	.79	.07	8.1
432	5	1.59	2.79	.78	.08	9.3
504	5	1.72	3.32	.78	.08	9.3
528	5	1.50	4.63	.79	.07	8.1
576	5	2.32	2.78	.77	.09	10.5
744	5	3.32	3.04	.76	.10	11.6
912	5	3.43	3.27	.74	.12	13.5
1176	5	1.69	1.09	.72	.14	16.3
1416	5	3.37	4.28	.72	.14	16.3
1416	10	3.37	4.28	.70	.16	18.6
1416	15	3.37	4.28	.64	.22	25.3

One half of the samples were copper plated and pack annealed in new charcoal at 1650° F, the copper being removed by a cyanide strip bath after the annealing cycle. Turnings were taken from the annealed sections to a depth of .005". These turnings were cleaned and degreased thoroughly, and the total lot from each sample was analyzed for carbon. Since there was not enough turnings available for an accuracy check, it was necessary to exercise extreme care with the original determination. The hardened sections of the samples were used to make micro hardness determinations.

Three test runs were made employing the above test procedure. The salt medium was the same type throughout all three tests. However, the method of rectifying the salt was varied as follows:

No. 1 Test Run:— No rectifier used.

No. 2 Test Run:— 2 oz, of SiO_2 (400 mesh) added each 24 hours.

No. 3 Test Run:— A.G.R. Graphite Rod inserted in the bath. The rod was re-removed and cleaned every 3 hours.

After obtaining the results of the carbon determinations, they were subtracted from the original carbon content. This revealed the actual drop in carbon content on the surface. An arbitrary comparison figure called the "Decarburization Index" of the salt was

TABLE III

Salt: E. F. Houghton & Co.'s Liquid Heat 1550—G.M. Specification #1850-M
Test Piece: G.M.—M2 Steel—Universal-Cyclops Steel Corp.—Heat #D-5087
Original Carbon Content: .80%
Operating Temperature: 2225°F.
Rectifier: AGR Graphite Rod
Nominal Life: 4116 Hrs. (Operated 1000 Hrs. in unrectified bath or 176 days)

Age of Bath	Soaking Time of Test Pc	Oxide Content of Bath		Carbon Content .005" Outside Layer	Loss of Carbon	Decarburization Index
		Soluble	Insoluble			
Hours	Minutes	%	%	%		
240	5	0.46	0.87	.80	0.00	0
240	10	0.46	0.87	.78	0.02	2.5
240	15	0.46	0.87	.77	0.03	3.75
480	5	1.03	0.97	.79	0.01	1.25
672	5	1.46	1.86	.79	0.01	1.25
960	5	1.75	2.16	.78	0.02	2.5
1152	5	1.87	2.05	.75	0.05	6.25
1152	10	1.87	2.05	.69	0.11	13.75
1152	15	1.87	2.05	.64	0.16	20.0
1248	5	1.87	1.90	.79	0.01	1.25
1248	10	1.87	1.90	.76	0.04	5.0
1248	15	1.87	1.90	.69	0.11	13.75
1344	5	2.28	2.19	.78	0.02	2.5
1344	10	2.28	2.19	.77	0.03	3.75
1344	15	2.28	2.19	.76	0.04	5.0
2000	5	2.16	2.03	.78	0.02	2.5
2000	10	2.16	2.03	.76	0.04	5.0
2000	15	2.16	2.03	.72	0.08	10.0

TABLE IV

Age of Bath—Hours	Soaking Time of Piece—Minutes	Rectified By	Vickers Hardness				Rockwell C Hardness (Converted)			
			.0007" From Surface	.0012" From Surface	.003" From Surface	Core	.0007" From Surface	.0012" From Surface	.003" From Surface	Core
360	5	None	479	479	556	776	47	47	52	62.5
590	5	None	428	465	573	775	43	46	53	62.5
662	5	None	396	406	406	780	40	41	41	62.5
384	5	SiO_2	523	630	717	787	50	56	60	63
576	5	SiO_2	493	611	717	785	48	55	60	63
744	5	SiO_2	465	479	650	888	46	47	57	66
1416	5	SiO_2	440	440	493	905	44	44	48	66.5
1416	10	SiO_2	417	465	523	935	42	46	50	67
480	5	Graphite	785	785	775	798	62.5	62.5	62.5	63
672	5	Graphite	850	873	888	908	65	65.5	66	66.5
960	5	Graphite	935	935	935	935	67	67	67	67
1344	5	Graphite	935	935	935	935	67	67	67	67
1344	10	Graphite	935	880	905	935	67	66	66.5	67
2000	5	Graphite	880	880	852	880	66	66	65	66
2000	10	Graphite	793	822	830	880	63	64	64.5	66

obtained by dividing the actual loss of surface carbon by the original carbon content.

$$\text{Decarburization Index} = \frac{\text{Original Carbon Content} - \text{Carbon Content After Hardening}}{\text{Original Carbon Content}}$$

The results are recorded in Tables I, II, and III.

Interpretation of Results

An examination of Tables I, II, and III reveals immediately the efficiency of Test Run No. 3 over the other two. Not only is the decarburization minimized by the graphite rod, but the electrode life is materially extended over that obtained when no rectifier is used. The use of SiO_2 as a rectifier is effective in lowering the decarburization index. However, the SiO_2 attacks the electrodes quite severely, and reduces the life on the same about 82%. The electrode used in Test Run No. 3 had operated 1000 hours in an unrectified bath before the bath employing the graphite rod was installed. One electrode failed after operating 3116 hours in the bath rectified with the graphite rod. The failure was caused by a short in the weld and *not* by the corrosive action of the bath. It is estimated that the electrodes would have operated at least 1000 additional hours had the weld not failed. Figure 1 is a picture of the electrodes after removal from the bath. It is evident that 50% of the electrode still remains at the bath line. (see page 16).

Table IV records the results of the micro hardness tests. These results reveal the effect on surface hardness created by the three test runs. It is evident that superior results are obtained in the bath rectified by the graphite rod.

Tables I, II, and III also shows the soluble and insoluble oxide contents of the baths at the time of operation on the samples. Although the presence of the graphite rod tends to reduce the oxide content, it it interesting to note that the decarburization is *not* proportional to the oxide content. At this writing this phenomenon is not explainable, since it is believed by contemporary metallurgists that the oxide content of the bath is the cause of decarburization and pitting on the parts processed.

An analysis of the coating which is deposited on the graphite rod reveals the following results:

Nickel	9.61%
Iron	7.01%
Chromium	0.4%
Ba O	2.59%
$Ba Cl_2$	66.8%

It is believed that the nickel from the electrodes and the iron from the parts processed enters the bath as oxides. These oxides are attracted to the graphite rod and are reduced to the metallic state, leaving the metal clinging to the rod. It should be noted that in the absence of the graphite rod the nickel will plate

out on the parts being processed. This is particularly true in the presence of Si O_2. When Si O_2 is used for a rectifier, it is necessary to use 28% Chrome-Iron electrodes if nickel plating on the parts is objectionable.

Figure 1 — Electrodes after removal from the bath containing graphite rod rectifier. Note that at least half of the electrode still remains at the bath line.

Conclusions

The results of this work should encourage the use of the graphite rod as a rectifier in neutral salts at high temperatures. At the present writing the action of the rod in baths operating below 1750° F. is not as effective as when operated above this temperature. Research is going forward at the present time to make the rod more effective at lower temperatures. The effect of the rod on neutral baths completely changes the results obtained on the parts and the maintenance economy of electric heated salt baths.

Care must be taken that the graphite rod is not allowed to extend above the bath surface. Further, it is not recommended that loose carbon or graphite be used. Any loose carbon or graphite floating on top of the bath that comes in contact with the parts being processed will cause severe pitting. Figure 2 is a sketch of recommended methods of anchoring the graphite rod.

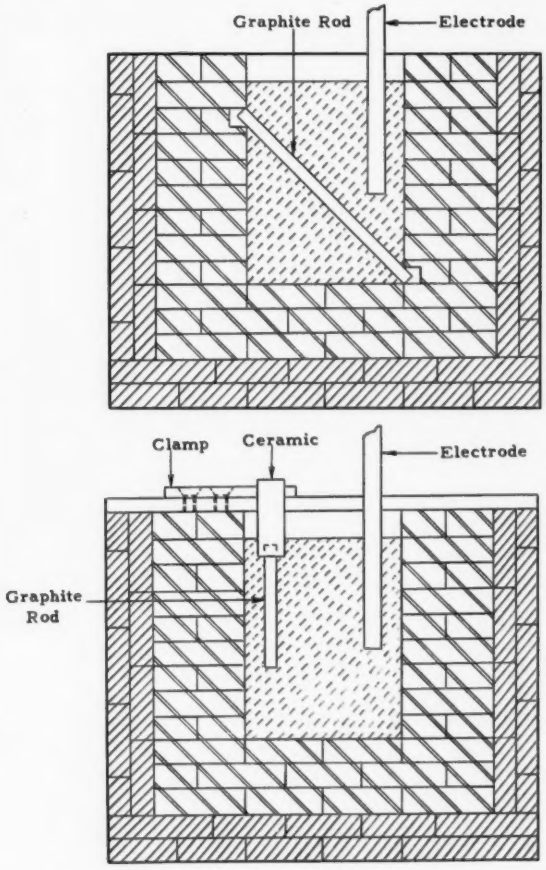


Figure 2 — Two suggested ways to anchor graphite rods for rectifiers in neutral salts.

The boy sat quietly in the day coach, a large wicker basket on his lap. An old lady sitting across the aisle noticed something dripping from a corner of the basket. Reaching over she caught a few drops on her fingers.

"Fresh country vinegar?" she asked the boy.

"No, ma'am. Puppies."

Say that you saw it in "METAL TREATING"

Manufacturer's Literature . . .

Editor's Note:

The literature listed below contains information of interest to heat treating organizations. For your copy write direct to the manufacturer and be sure you mention seeing it reviewed in "Metal Treating."

"Water Engineering Service"

New ten-page brochure describes available professional service relating to "Your Most Important Raw Material—Water." Presents description of *plant-wide water service*, and of facilities and operation of the water research organization. Available free from Hall Laboratories, Inc., Dept. IL, Hagan Building, Pittsburgh, Pa.

"Research Services"

A new fully illustrated 48-page brochure describes the services, facilities and personnel of the *Cook Research Laboratories* which are available to Government agencies and private industry on a contract basis. Copies are free on request. Write the Cook Research Laboratories, Dept. IL, 1457 Diversey Parkway, Chicago 14, Ill.

"Photometric Oil Color Readings"

A new method for the photometric color grading of oils and fats with a spectrophotometer, as approved by the American Oil Chemists' Society, is described in "Waco Color Tips." Four-page publication by Waco Technical Service. Another publication describes the determination of water by a simplified procedure. Copy free on request. Write Wilkens-Anderson Co., Dept. IL, 4525 West Division Street, Chicago 51, Ill.

* * * *

"New Laboratory Equipment"

A new 16-page issue of "What's New for the Laboratory" has just been released by the Scientific Glass Apparatus Co. Inc. of Bloomfield, New Jersey—No. 11 in the series. It illustrates and describes a number of new interesting items including a Varicell which eliminates storage batteries, a quadrant culture plate, a flask with special cork insulated top to prevent burns to hands, and a vacuum oven that's heated by radiation. It also tells about a new microscope lamp featuring optical control of light intensity, a new type mortar and pestle, a tubular filter made of fritted glass, a sponge particularly adapted to laboratory use, and introduces an ASTM certified thermometer testing set. All told, twenty items are illustrated and described. This issue also shows a picture of Scientific Glass' new paint with interior views of their huge new stockrooms.

A free copy of "What's New for the Laboratory" can be obtained by writing directly to the Scientific Glass Apparatus Co. Inc. of Bloomfield, New Jersey.

"Heat Treating Ovens"

Young Brothers Company is offering a 12-page folder describing its complete line of heat treating ovens. This folder illustrates examples of standard and special designs comprising 3 major categories—Batch Type—Pit Type—Continuous Conveyor Type. These ovens, using heat up to 1000°, are for use in heat treating products made of steel, cast iron, aluminum, brass, bronze, magnesium, glass and plastics. Copies of this bulletin 4-T may be obtained by writing to Young Brothers Company, 1831 Columbus Road, Cleveland 13, Ohio.

"Controlled Atmosphere Gas-Fired Furnace"

Descriptive piece published by A. D. Alpine, Inc., Culver City, California, provides illustrations and well-detailed specifications of three models of their line of heat treating furnaces. Prices are also given.

"Thermocouples for all Pyrometers"

An illustrated 8-page booklet published by Thermo Electric Co., Inc., Fair Lawn, New Jersey. The booklet illustrates many standard models of Thermocouples, assemblies and parts covering most applications encountered in industry.

"Cyclograph—Automatic Sorting Equipment"

Data Sheet 2005, published by the J. W. Dice Company, describes a new automatic unit which permits the non-destructive analysis and sorting of metal parts. The equipment permits sorting by metallurgical characteristics including analysis, structure, hardness, heat treatment, case depth.

"Nitroneal Generator"

A new four-page bulletin published by Baker & Co., Inc., 113 Astor Street, Newark 5, N. J., describes their Nitroneal Generator and provides some interesting cost comparisons, a flow diagram of an installation and other general information.

"The Deoxo Processes for the Catalytic Purification, Hydrogenation and Oxidation of Gases"

also published by Baker & Co., is an eight-page bulletin which gives very complete details of what the various Deoxo units can do in the control and regulation of gases.

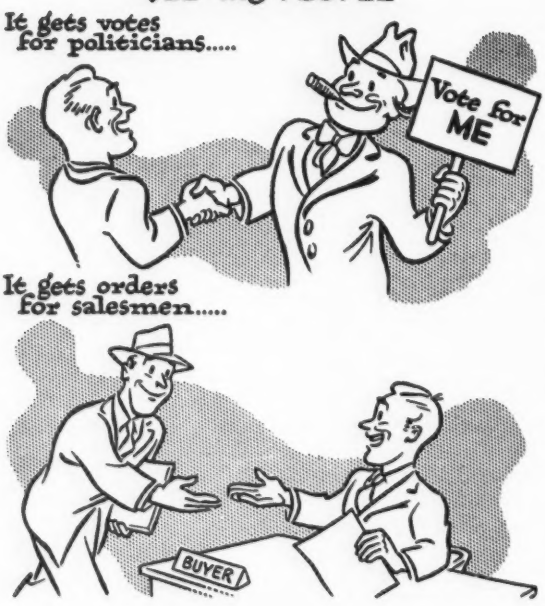
"Now You Can Control Homocarb Atmosphere as Easily as Temperature"

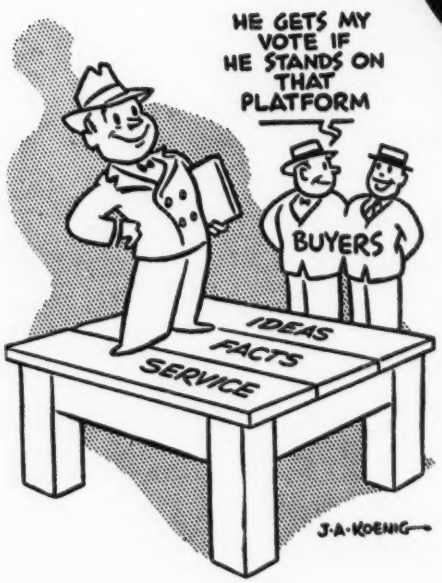
is a pamphlet by Leeds & Northrup Co., 4908 Stenton Avenue, Philadelphia 44, Pa., on their new Homocarb Atmosphere Device which has not yet been released. The small folder illustrates and describes concisely what can be accomplished and how. Future bulletins will be announced.

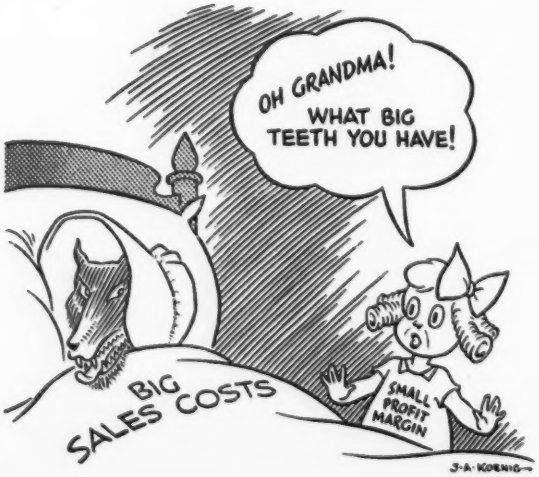
(Please turn to page 21)

HOT TIPS FOR SALESMEN

"SEE *the* PEOPLE"







Wrong Guys

NEW THINGS AT THE METAL SHOW

There were six new items on display at the Metal Show in Chicago which will prove of particular interest to commercial heat treaters. These were:

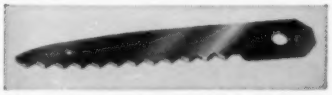
1. A small, low cost Pangborn Hydrofinish unit. (See *Thermo-Couplettes, page 10*)
2. Leeds & Northrup's new and most interesting Homocarb Atmosphere Control. The instruments, calibrated directly in carbon percentage, permit regulation of the carbon potential of furnace atmosphere, a record of carbon potential during the heat treating cycle. It is claimed that an operator may control furnace atmosphere just as easily and regularly as he controls temperature. (See booklet announcement page 17)
3. Baker & Co., Inc., Newark, N. J., exhibited a Nitroneal Generator claimed to produce pure nitrogen accompanied by definite regulation of hydrogen content. The unit permits the use of commercial anhydrous ammonia to develop nitrogen-hydrogen non-explosive atmospheres at low cost. One ammonia cylinder it is claimed will provide sufficient finished gas equal to 50 to 60 nitrogen cylinders. (See literature announcement page 17)
4. Lindberg Engineering Company displayed their latest equipment developed for carbonitriding in automatic electric furnaces. (See literature announcement, page 21)
5. An Electric arc drill manufactured by the Elox Corporation, Clawson, Michigan. This drill permits electric drilling through hard metal without softening the adjoining material and can cut various shaped holes. It is excellent, for example, for obtaining pieces for metallographic examination.
6. The Standard American Engineering Co., Lyons, Illinois displayed for the first time their new Radivection Furnace (see September "Metal Treating" Pages 4-6). The furnace is said to have a new principle of heat transfer which provides higher temperature uniformity during operation.

No Cleaning Problems with PARK-KASE 5-C

WATER SOLUBLE LIQUID CARBURIZER

Automotive door parts. Carburized up to 40 min. in PK-5C at 1500° F. oil-quenched. Case depths .008" to .012". All parts cadmium plated after casing in free-cleaning PK-5C.

Screw nut SAE 1118 oil quenched from PK-5C at 1550° F. 2 hours .020" case depth. Jack screw SAE 1027. In PK-5C for 20 min. roller quenched in oil. Pieces washed and plated.



Pinking shear blades .014" case in 1 hour at 1600° F. in PK-5C. Oil quench.

HEAT TREAT SUPERVISORS tell us that Park-Kase 5-C gives them absolutely trouble-free salt bath liquid carburizing; cuts time all around; requires no skilled help, yet assures accurate control.

EVEN THE MOST INTRICATE PARTS can be quickly cleaned from water-soluble Park-Kase 5-C, emerge with a gleaming, silvery finish, suitable for plating or not, as required.

FAST, REPRODUCIBLE CASES can be easily held to close limits for accurate, dependable work at temperatures up to 1750 degrees.

NON-HYGROSCOPIC PARK-KASE 5-C won't corrode metal pots, fixtures or finished work; won't precipitate sludge; won't foam during operation or while additions are being made. A carbon cover forms to protect men from excessive heat and fumes.

An extremely fluid bath, Park-Kase 5-C requires a light-weight original charge and maintains efficient carburizing activity by the replenishment of normal dragout. Park-Kase 5-E Energizer is added where conditions of unusually low replenishment are present.

SEND TODAY FOR:

NEW TECHNICAL BULLETIN

Completely describes use and operation of water soluble liquid carburizing baths.

Park CHEMICAL COMPANY
8074 MILITARY AVE.
DETROIT 4, MICH.

Tempilstik°

the amazing Crayons that tell temperatures

A simple method of controlling working temperatures in:

- **WELDING**
- **FLAME-CUTTING**
- **TEMPERING**
- **FORGING**
- **CASTING**
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- **STRAIGHTENING**
- **HEAT-TREATING IN GENERAL**

It's this simple: Select the Tempilstik° for the working temperature you want. Mark your workpiece with it. When the Tempilstik° mark melts, the specified temperature has been reached.

$2 each

gives up to 2000° readings

Available in these temperatures (°F)

113	263	400	950	1500
125	275	450	1000	1550
138	288	500	1050	1600
150	300	550	1100	1650
163	313	600	1150	1700
175	325	650	1200	1750
188	338	700	1250	1800
200	350	750	1300	1850
213	363	800	1350	1900
225	375	850	1400	1950
238	388	900	1450	2000

Also available in pellet or liquid form.

FREE —Tempil° "Basic Guide to Ferrous Metallurgy" — 16¼" by 21" plastic-laminated wall chart in color. Send for sample pellets, stating temperature of interest to you.

METAL & THERMIT CORPORATION
100 EAST 42nd STREET,
NEW YORK 17, N. Y.

6 Reasons Why You Should Join

The

Metal Treating Institute

The Commercial Heat Treaters

OWN

Organization

1. It protects and advances interests of membership.
2. It promotes the use of commercial heat treating services.
3. It fosters and supports fair business practices.
4. It works to protect the industry against unfair and unjust burdens or lack of appreciation of its importance and significance.
5. It collects and assimilates pertinent data relating to the industry.
6. It promotes better relations between members, employers and employees.

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METAL TREATING INSTITUTE

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271 North Avenue

New Rochelle, N. Y.

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Mr. C. W. Derhammer, Lakeside Steel Improvement Co., Cleveland, Ohio.

Spring Meeting Dates Established

At the Fall meeting it was definitely decided that the 1951 Spring meeting would be held May 28-30. Plans are already being made for an active and worthwhile program. As announced in the last issue of "Metal Treating," the meeting will be held at the Hotel Colorado, Glenwood Springs, Colorado.

Personals

C. U. Scott & Son, Inc., Exhibit

Oldtime member, C. U. Scott, had a neat and interesting exhibit at the Metal Show in Chicago which was held during the week of October 23. He displayed many stainless steel parts which had been heat treated by the well-known Super Scottsonizing process.

Also at this time he distributed for the first time a new and interesting booklet entitled "Methods to be used in the preparation of Stainless Steel for Hardening." Be sure and write for a copy.

C. W. Derhammer, President, writes us that The Lakeside Steel Improvement Company, specializing in scientific commercial steel treating, is installing new equipment at a cost of $50,000 to facilitate advanced methods in the processing of steel. This is being done in anticipation of added demands for the defense effort. The company's plant is located at 5418-20 Lakeside Avenue, Cleveland, Ohio.

APOLOGY

Through one of those little errors so hard to eliminate completely, the name of the Fred A. Snow Company, 1942 West Kenzie Street, Chicago 22, Illinois, was omitted from the roster of members in our last issue. We are sure, however, that Clint Snow will accept our apology and we won't let it happen again.

"Lindberg Induction Heating Units"

Lindberg Engineering Company, 2450 West Hubbard Street, Chicago 12, Illinois, has issued a new Bulletin No. 1440. The bulletin contains eight pages and thoroughly describes these heating units, their main features and specifications. Also standard accessory equipment is described. They also offer a very brief single sheet, Bulletin T-240, illustrating diagrammatically the application of Lindberg dry or gas equipment to an elevator quench type furnace and a tilting vibrating hearth type furnace.

"Combination Burner"

Heat releases up to 750,000 Btu per cubic foot of combustion volume can be obtained with the high thermal release burner announced by Bloom Engineering Co., Inc., Pittsburgh 33, Pa. This combination oil and gas unit for all furnaces requiring high temperatures and intense transfer of heat to materials, has a turndown ratio of greater than 10 to 1 that enables low input for holding purposes.

HEAT
Treating
SUPPLIES
AMAZING! NEW! QUENZINE!
For over a quarter of a century Beacon Quenching Oils have been known for their extremely high effectiveness. Now, after exhaustive research, our laboratories have developed a new additive that even further increases their efficiency. Beacon Brand Oils with "Quenzine" added extract 8 to 80% more heat from the steel in the first five seconds than other oils, thus giving the best hardness with the least distortion. Write for "The Quenzine Story."
The
J.W. KELLEY
Company
K
3401 W. 140th ST., CLEVELAND 11, O.
PHONE—Clearwater 1-3505

Thermo-Couplettes (Cont.)

Like standard Hydro-Finish cabinets, the new model uses a wide range of abrasive sizes (as fine as 5000 mesh) and produces a variety of surface finishes. There is no breakdown of sharp edges and corners and tolerances can be held to within .0001 of an inch.

The new cabinet is unique in design and extremely compact. It is constructed of a substantial one-piece aluminum casting and is equipped with excellent lighting, armholes, air filter, exhaust fan and vision window. A detachable abrasive hopper allows easy cleaning.

Inside diameter is 15" and floor space required is only 17"x22½". Height is optional. Complete weight about 60 pounds. Does not require bolting to floor; all you do is connect to air supply and plug electrical cord into 110 volt AC outlet.

This new model Hydro-Finish uses water (to which corrosion inhibitors may be added), fine non-metallic abrasives and compressed air (80 p.s.i.) to clean and finish a wide range of work and materials—tools, jewelry, small rubber, plastic and glass molds, dentures and many others. It is considered ideal for garages, machine shops, commercial heat treating plants, or for small jobs in large industries.

Further details may be obtained by writing Pangborn Corporation, Hagerstown, Maryland.

Pre-Wired Control Panel Makes Easy Installation of Electric Furnace Line

Installation of the TEMCO line of electric furnaces is made simple and easy by a new wired control panel which attaches to the furnace body. The panel is available with several sizes of furnaces and houses the temperature controller together with the load carrying relay, thermo-couple lead and fused disconnect switch. Electrical wiring of all these parts is complete, it being only necessary for the user to attach the panel to the furnace with screws provided and make two simple connections to the furnace and one to the electric line.

Either a fully automatic electronic pyrometer-controller, or a manually operated controller-indicator may be used in the control panel. The electronic controller permits the operator to pre-set the control for the required temperature which will be automatically attained and maintained, while the manual control, at nominal cost, allows the operator to regulate the temperature by manual adjustment of the control knob.

Several recent improvements have also been made in the construction of the furnaces themselves, including more efficient insulation and improved design of the heating elements for faster, more efficient heating.

This equipment is available in various convenient sizes and is designed for hardening, drawing, annealing, pre-heating for high speed hardening and general laboratory work requiring temperatures up to 1900° F. A data file containing illustrations and specifications is available by writing Thermo Electric Mfg. Company, 480 West Locust Street, Dubuque, Iowa.

Wrap Pack Annealwork In Paper

The following method has been used by Cook Heat Treating Corp., Los Angeles, Cal. for many years although it may be news to some metal treaters.

Work requiring pack anneal in cast iron chips or mica can be removed from the pack after heat treatment free from adhering particles of packing material if the parts were wrapped in two thicknesses of medium weight wrapping paper prior to packing.

Of course, the paper burns away, but the ash residue surrounding the parts is sufficient to prevent cohesion of foreign matter on the surface of the work and therefore obviates a subsequent cleaning operation.

"You couldn't possibly have him stone cold in the morgue—he's right here with me in the same condition."

Oh, To Be a Salesman!

A Salesman must be a before-dinner drinker and an after-dinner speaker; he must work all day, drive all night and appear fresh next day. He must be able to entertain the customer's wives and sweeties and pet all kinds of stenographers – without becoming amorous.

He must be a man's man, a ladies' man, a model husband, a fatherly father, a devoted son-in-law, a good provider, a Bohemian, a Conservative, a Liberal and radical; a New Dealer, a fast dealer, a singer and an actor as well as a musician, physician, technician and magician.

He must be a sales promotion expert, create a demand for obsolete merchandise, be a good credit manager and correspondent, attend all parties, tournaments, and funerals; visit customers in the hospitals and jails, and in spare time look for new business, collect delinquent accounts, do missionary work and attend sales conferences.

He must be an expert driver, talker, liar, dancer, golfer, diplomat, financier and philanthropist —as well as an authority on palmistry, chemistry, archaeology, psychology, physiology, meteorology, criminology, communism, socialism and hypnotism. Also a lover of music, dogs, cats, birds, fish, horses, blondes, brunettes, redheads, and lingerie—and all this without letting it interfere with his work.

OH, TO BE A SALESMAN!

Say that you saw it in
"METAL TREATING"

Houghton's NEW Salt Bath Book!

A revision of our catalog listing salt bath materials, their properties and uses, has just been completed. It describes salts for carburizing, hardening, annealing, drawing, martempering and treating high speed steel. It tells you why you can "do it better in Salt," based on the experience of Houghton technical men who have long specialized in metal processing. Mail coupon below for your free copy.

Mail To: E. F. HOUGHTON & CO.
303 W. Lehigh Ave., Philadelphia 33, Pa.

Please send me the NEW Houghton Salt Bath Book.

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ASSOCIATION OF MASTER CRAFTSMEN

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Cleveland 14, Ohio

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Detroit 8, Michigan

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Los Angeles 11, California

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Dayton 3, Ohio

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Harris Metals Treating Co.
1745 Taylor Avenue
Racine, Wisconsin

Fred Heinzelman & Sons Co.
138 Spring Street
New York 12, New York

Alfred Heller Heat Treating Co.
391 Pearl Street
New York 7, New York

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1536 West Pierce Street
Milwaukee, Wisconsin

Industrial Steel Treating Co.
600 Fallon Street
Oakland 7, California

L-R Heat Treating Co.
680 South 16th Street
Newark, New Jersey

Lakeside Steel Improvement Co.
5418 Lakeside Avenue
Cleveland 14, Ohio

Lindberg Steel Treating Co.
222 North Laflin Street
Chicago 7, Illinois

Maryland Tool Company
111-13 Hollingsworth Street
Baltimore 2, Maryland

Metal Treating & Research Co.
651 Sherman Street
Denver 3, Colorado

Metal Treating, Inc.
720 South 16th Street
Milwaukee 4, Wisconsin

Metallurgical Control Labs.
2226 East Lake Street
Minneapolis 7, Minnesota

Metallurgical Service Co.
1020 East Michigan Street
Indianapolis 2, Indiana

Metlab Company
1000 East Mermaid Lane
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New England Metallurgical Corp.
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Ohio Heat Treating Co.
1100 East Third Street
Dayton 2, Ohio

Pearson Industrial Steel Treating
5757 Ogden Avenue
Chicago 50, Illinois

Perfection Tool & Metal Heat Treating Co.
1740 West Hubbard Street
Chicago 22, Illinois

Pittsburgh Commercial Heat Treating Co.
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Pittsburgh 1, Pennsylvania

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Somerville 43, Massachusetts

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1265-71 East 55th Street
Cleveland 14, Ohio

Precision Heat Treating Co.
216 William Street
New York 7, New York

Queen City Steel Treating Co.
2980 Spring Grove Avenue
Cincinnati 25, Ohio

J. W. Rex Co.
834 West Third Street
Lansdale, Pennsylvania

Stanley P. Rockwell Co.
296 Homestead Avenue
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C. U. Scott & Son, Inc.
1510 First Avenue
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Chicago 22, Illinois

Spindler Metal Processing Co.
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Supreme Metal Treating Co.
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Milwaukee 4, Wisconsin

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Manitowoc, Wisconsin

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Racine, Wisconsin

Wesley Steel Treating Co.
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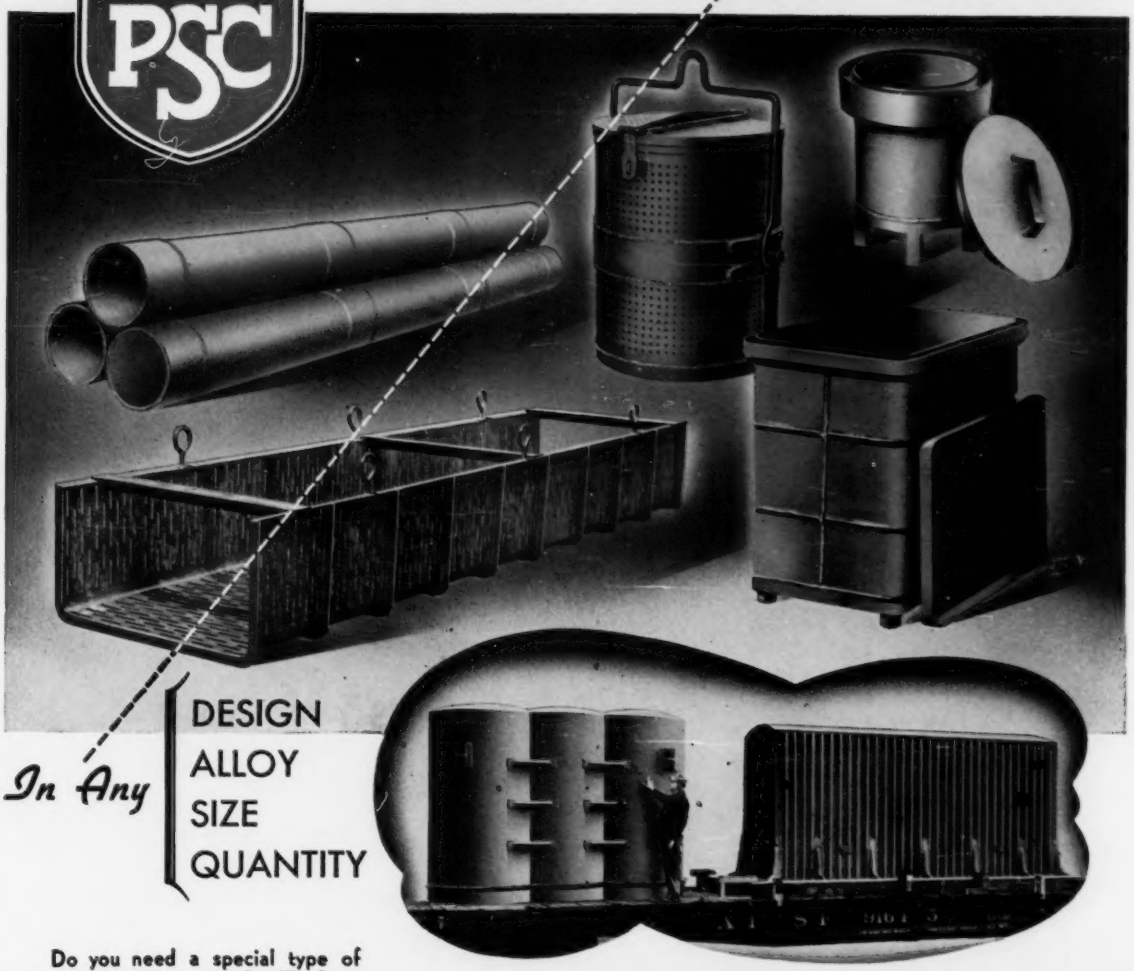
Limekiln Pike
Dresher, Pennsylvania

The PRESSED STEEL CO.

PSC

ANNEALING CONTAINERS & COVERS



In Any

DESIGN
ALLOY
SIZE
QUANTITY

Do you need a special type of annealing equipment?...We have designed containers and covers for every imaginable product.

Have you a temperature problem?...We fabricate from the entire list of heat-resisting alloys.

Are size of the equipment or quantity required a cause for consideration?...As indicated by the illustrations, we furnish boxes, baskets, etc., for the smallest parts, or covers for the biggest steel mill anneals -- singly or by carload.

Weigh Up to 2/3 Less. Save Time and Fuel

Here are 4 ways that "Pressed Steel" light-weight annealing units cut costs and speed production, as shown by plant records:

1) FUEL SAVING--Made of light gauge welded sheet alloy, they require less fuel and time to attain pot heat.

2) LABOR SAVING--Handle easier and faster.

3) REPLACEMENT SAVING--Some installations have been in constant service for 20 years.

4) SPACE SAVING--Being less bulky than cast units, installations have frequently doubled furnace capacity.

We furnish a complete line of annealing and carburizing boxes, covers, baskets, racks, tubes, retorts, etc. As pioneers of sheet-alloy heat-treating equipment, we offer a wealth of experienced engineering assistance. Send blue prints or write as to your needs.

THE PRESSED STEEL COMPANY

of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

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SAECO

RADIVECTION

PAT. PEND.

HEAT TREATING FURNACES

FOR

HARDENING • ANNEALING
NORMALIZING • TEMPERING
ALUMINUM TREATING, ETC.

UNIFORM HEATING

INCREASED EFFICIENCY

HIGHER PRODUCTION: FASTER INITIAL HEATING • *SHORTER SOAKTIME*

. . . with this new pit type recirculating furnace, combining radiation and convection methods of heat transfer.

The one furnace design is adaptable to various heat treating applications at temperatures from 250°F to 1750°F in three temperature ranges: 250°F to 850°F, 250°F to 1400°F, 250°F to 1750°F.

Temperature and power controllers are engineered for the furnace to fit specific application. RADIVECTION FURNACES are available in all sizes.

* ***For further information write to or call . . .***

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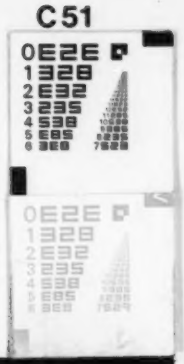
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